

OCCURRENCE OF NEONATAL AND POSTNATAL MORTALITY IN RANGE BEEF CATTLE. I.
CALF LOSS INCIDENCE FROM BIRTH TO WEANING, BACKWARD AND BREECH
PRESENTATIONS AND EFFECTS OF CALF LOSS ON SUBSEQUENT PREGNANCY RATE
OF DAMS¹

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ABSTRACT

Data from 13,296 calvings collected over a 15-yr period indicated 893 calves died from birth to weaning for an average loss of 6.7%. Calves lost from birth through Day 3 postcalving accounted for a 4.6% loss with an additional 2.1% loss from Day 4 through weaning. Calf deaths from primiparous 2- and 3-yr-old dams accounted for 41.0% of total mortality. Losses within groups were primiparous 2-yr-olds, 10.9%; primiparous 3-yr-olds, 8.7%; second-calf 3-yr-olds, 4.1%; second-calf 4-yr-olds, 8.3%; multiparous 4-yr-olds, 4.8%; and dams 5 yr and older, 5.3%. The majority of calf deaths (57.4%) occurred within the first 24 h postpartum with 75% of the total occurring Days 0 through 7. This loss was similar among all dam age and parity groups. Calf death due to dystocia accounted for the single largest loss category through the first 96 h postpartum, resulting in 69.6, 39.6, 30.8 and 33.3% of the loss incidence for Day 0, 1, 2 and 3 postpartum, respectively. More ($P < 0.01$) male calves (510, 57.6%) died than females (376, 42.4%). Backward presentations occurred more frequently ($P < 0.01$) than breech (1.6 vs 0.6% of all births, respectively). Incidence of backward presentation was 2.3%, 5.6% and 0.9% for primiparous 2-yr-old, 3-yr-old and multiparous dams, respectively ($P < 0.01$); 64.2% of the backward calves were males and 35.8% females ($P < 0.01$). Survival of calves in backward presentation exceeded ($P < 0.01$) that of breech calves (70.7 vs 32.9%). Fall pregnancy rate of dams that lost calves and reentered the breeding herd that same year was 72.4% compared to 79.4% ($P < 0.01$) for contemporary females that did not lose calves. The depression in pregnancy rate was not specifically due to dystocia but apparently to some general effect of calf loss.

Key words: beef cattle, perinatal mortality, dystocia, pregnancy

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INTRODUCTION

Previous studies have reported incidence of stillbirths (calves born dead) ranging from 2 to 11% (1-7) with stillbirths accounting for 56.4% of total deaths recorded from birth to weaning (8). Baker and Quesenberry (9) noted calf death losses of 6% between the spring-calving date and December 31 of the same year. More recent work indicated an overall mortality incidence of 8.6% (10) with losses from birth to weaning resulting in an average 4.1% reduction in net calf crop (11-13). Year, season and location have also been reported to affect calf survival (14).

Calf loss and/or lactation status also may influence subsequent reproductive performance of the dam (15,16). Rasbech (17) reported a 13 to 14% reduction in number of cows conceiving at first, second and third inseminations after giving birth to a dead fetus. Wiltbank et al. (14) found that in mature dams, lactation status the previous year influenced calving percentage the following year. Fewer calves were lost within the first 36 h postpartum and a greater proportion of calves were weaned among dams bred while lactating.

The objectives of this study were to determine the incidence of calf mortality from birth through weaning at approximately 6 mo of age in range beef cattle at the Fort Keogh Livestock and Range Research Laboratory, Miles City, MT, and to evaluate the effects of calf loss on subsequent reproductive performance of the dams. Data are published in two parts; paper I summarizes data from all animals involved in the study, while paper II summarizes necropsy results (18).

MATERIALS AND METHODS

Data were collected from 13,296 calvings from the years 1963 through 1977. Sources of data were: field calving reports, autopsy reports of calves that died from parturition to weaning, breeding herd records and fall pregnancy diagnoses. Data used to evaluate incidence of neonatal and postnatal mortality included: year of occurrence, numeric identification of the dam and calf involved, and calf birth date, weight and sex. Additional information included types of birth, calf presentation, single or multiple birth, difficulty encountered and viability status at parturition of the calf. All multiple births reported involved parturitions producing two calves. The data also included time of death expressed in number of days from date of birth (with first 24 h postpartum = Day 0).

Data examined in relation to the dam included age of dam in years at the time of calf loss, parity and lactation status the previous year (lactating, nonlactating, or first parturition), and pregnancy status the fall immediately following calf loss. Parity and age-of-dam groupings included: primiparous 2-yr-olds; primiparous 3-yr-olds; and multiparous dams (second-calf cows and older). Dams that were bred to calve as 2-yr-olds and failed to do so, but were retained in the breeding herd and calved the following year, were not included in the second-calf 3-yr-old grouping, but were included in the first-calf 3-yr-old group. The maximum cow age at calving was 13 yr.

Follow-up data collected on dams losing calves included survival of the dam, information regarding sale or retention and subsequent exposure for breeding, and subsequent fall pregnancy status (pregnant, nonpregnant). Pregnancy rates for dams losing calves (primiparous 2-yr or 3-yr-old and multiparous dams) were compared to contemporary pregnancy rates at this Laboratory within the respective age and parity groupings of dams not losing calves. Cow inventories by age and parity of dam were used to determine the number of cows exposed for breeding and their subsequent fall pregnancy status. Numbers of cows calving by respective age and parity group were also obtained.

Calving sites for the majority of the herds at the Laboratory were representative of a range calving operation. Primiparous heifers were calved separately from multiparous females. Range calving areas contained shelter provided by trees or brush cover. Facilities and equipment were available at all calving locations for providing obstetrical assistance if the need arose. Herdsmen were responsible for 24-h observation of primiparous heifers and observation during daylight hours of mature dams prior to parturition. Herdsmen were trained to provide obstetrical assistance if, in their judgment, the situation deemed it necessary. Parturitions involving severe fetal malposition, extreme traction or cesarean deliveries were completed by licensed veterinarians. Herd health measures were directed toward disease prevention based on recommendations of veterinary consultants at Montana State University, and the herd was free from known diseases throughout the period of the study. Other descriptions of management practices at this research location are presented elsewhere (19,20).

Data were analyzed using Chi-square and analysis of variance procedures. Enumeration data pertaining to calf death losses were analyzed using Chi-square (21), and mean comparisons were completed by the Newman and Keuls method (22). Statistical analyses were conducted with the aid of the Statistical Package for Social Sciences (23).

RESULTS AND DISCUSSION

Calf Loss Incidence

A total of 893 calves died during the 15-yr study resulting in a 6.7% average death loss among the 13,296 calvings. This value is similar to that reported by Baker and Quesenberry (9), but lower than the 8.6% loss reported by Laster and Gregory (10). It was not the objective of this study to make a detailed genetic analysis of the losses. However, 446 and 447 calves were lost from straightbred and breedcross matings, respectively. Of the 446 straightbred calves lost, 302 were inbred with inbreeding coefficients ranging from 10 to 45%. A detailed summary of effects of inbreeding on calf survival is available (24).

The number of calvings and calf losses by year, percentage death loss within year and percent of total death loss/year are shown in Table 1. The difference ($P < 0.01$) in number of losses among years observed was similar to differences reported by others (14,25). Loss percentages were highest in 1974 (9.3%) and 1975 (13.2%). These high

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loss percentages reflected increased calf deaths due to severe weather conditions during the calving season and resultant deaths due to chilling/exposure, pneumonia and scours. Single births accounted for 858 (96.1%) of the 893 recorded deaths, and 35 (3.9%) of the dead calves included in the study were twins.

Table 1. Calvings and calf losses per year: 1963-1971^a

Year	No. females calving	No. calves lost/year**	Annual loss, %	Percent of total loss, % ^b
1963	667	50	7.5	5.6
1964	672	44	6.5	4.9
1965	730	59	8.1	6.6
1966	719	48	6.7	5.4
1967	947	46	4.8	5.2
1968	798	28	3.5	3.1
1969	917	58	6.3	6.5
1970	938	58	6.2	6.5
1971	950	44	4.6	4.9
1972	923	46	5.0	5.2
1973	938	52	5.5	5.8
1974	981	91	9.3	10.2
1975	1110	147	13.2	16.5
1976	976	58	5.9	6.5
1977	1030	64	6.2	7.2
Total	13,296	893	6.7 ^c	100.0

^a Losses represent deaths occurring from birth to weaning.

^b Percent of total loss over the 15-yr period.

^c Average calf mortality percentage.

**P < 0.01.

Differences in calf losses by dam age and parity were highly significant and are shown (Table 2). Of the total mortality incidence, 59.5% represented losses from primiparous and second-calf dams, with 41.0% of the losses occurring in primiparous 2- and 3-yr-old dams. This represented only 27.4% of the total calvings. The remaining 59.0% of the losses occurred in multiparous dams, which represented 72.5% of the calvings. Of the 527 multiparous dams losing calves, 442 (83.9%) weaned calves the year previous to loss, while 85 (16.1%) did not. A trend toward lower calf mortality following the first parturition continued through 6-yr-old dams. Calf deaths tended to increase in dams 7 yr of age and older; however, numbers of calvings and losses were small in the oldest groups (Table 2). Calf deaths were lowest among intermediate-age mature dams. These differences due to age and parity of dam are similar to other reports (2,10,26).

Table 2. Calvings and calf deaths by dam age and parity

Age and parity of dam	No. of dams calving	Calf deaths within dam age and parity group		% of all deaths
		No.**	%	
2-yr	2,257	245	10.9	27.4
1st-calf 3-yr	1,394	121	8.7	13.5
2nd-calf 3-yr	1,461	60	4.1	6.7
2nd-calf 4-yr	1,262	105	8.3	11.8
3rd-calf 4-yr	1,032	50	4.8	5.6
5-yr	1,760	76	4.3	8.5
6-yr	1,406	65	4.6	7.3
7-yr	1,050	64	6.1	7.2
8-yr	753	44	5.8	4.9
9-yr	486	30	6.2	3.4
10-yr	298	22	7.4	2.5
11-yr	104	9	8.6	1.0
12-yr	28	2	7.1	0.2
13-yr	5	0	0.0	0.0
Total	13,296	893	---	100.0

** $P < 0.01$.

A nonsignificant difference in incidence of calf death was observed between primiparous 2-yr-old (10.9%) and 3-yr-old (8.7%) dams. Percentage contributions toward the total death incidence for calves produced by primiparous 2- and 3-yr-old dams were 27.4 and 13.5%, respectively. However, losses from primiparous 2- and 3-yr-old dams were greater ($P < 0.01$) than from all other dam groupings.

There was a difference (interaction, $P < 0.01$) in subsequent calf losses between dams calving first at 2 vs those calving first at 3 yr of age. Percentage of reductions in calf deaths from first to second calving was greater in dams calving first at 2 yr of age (10.9 vs 4.1%) compared to dams calving first at 3 yr of age (8.7 vs 8.3%). A portion of this difference was due to the culling rate imposed on the females and also to the method of assembling the data. In primiparous 2-yr-olds that lost calves, 36.3% were culled vs 9.5% of the primiparous 3-yr-olds. In assembling the data, heifers that were bred to calve at 2 yr of age and failed to do so, but were retained and did calve at 3 yr of age, were included in the first-calf, 3-yr-old group. This inflated the loss percentage of this group; when these animals were removed the death percentage dropped from 8.7% to 6.6%. Further evaluation of these data, however, revealed that 66% of the total calf deaths within the 5-yr-old dam group (50 of 76) resulted from calvings in third-calf, 5-yr-old dams which were the retained females that had failed to calve at 2 yr of age. These results suggest that, under the existing management conditions, the majority of the 2-yr-old dams that experienced calf loss or subsequently failed to conceive were culled and recurrent calving problems were eliminated, but females that were retained experienced higher calf losses. Thus, failure to conceive (calve)

following the first breeding season as a yearling heifer appears to represent a valid culling criterion. This finding extends the conclusions of Dziuk and Bellows (27) and suggests the need for further investigations.

The loss incidence by day of death from the date of calving is summarized in Table 3. Our finding that the majority of losses (57.4%) occurred within the first 24 h postpartum (Day 0) agrees with prior reports (6,17,28). Cumulative loss within the first 8 d (Days 0 through 7) postpartum accounted for 75% of total calf deaths with 11% of the total occurring from Day 42 to weaning. The second largest group of calf deaths occurred Days 1-10 postpartum (21.8%), while those from Day 11 postpartum through weaning accounted for 20.7% of the total.

Table 3. Calf losses by time of death and category of greatest loss

Day of death ^a	Calf deaths			Greatest death category			
	No.	%**	Cumulative loss, %	Category	No.	% of deaths	
						Within day	Of total deaths
0	513	57.4	57.4	Dystocia	357	69.6	40.0
1	48	5.4	62.8	Dystocia	19	39.6	2.1
2	26	2.9	65.7	Dystocia	8	30.8	0.9
3	27	3.0	68.8	Dystocia	9	33.3	1.0
4	18	2.0	70.8	Euthanasia	4	22.2	0.4
5	11	1.2	72.0	Accidental death	6	54.5	0.7
6	13	1.5	73.5	Pneumonia; scours	6	46.2	0.7
7	14	1.6	75.0	Pneumonia; scours	6	42.9	0.7
8	15	1.7	76.7	Pneumonia; scours	4	26.7	0.4
9	13	1.5	78.2	Pneumonia; scours	5	38.5	0.6
10	10	1.1	79.3	Pneumonia; scours	4	40.0	0.4
11-41	87	9.7	89.0	Pneumonia; scours	35	40.2	3.9
42-101	51	5.7	94.7	Missing/unknown ^b	25	49.0	2.8
102-wean	47	5.3	100.0	Missing/unknown ^c	23	48.9	2.6
Total	893	100.0	100.0		511		57.2

^a Day 0 = death occurred within the first 24 h postpartum; Day 1 = death occurred 24 to 48 h postpartum, etc.

^b Of the 25 missing/unknown calves that died during Days 42 to 101, three were found dead and 22 were missing and not found.

^c Of the 23 missing/unknown calves that died during Days 102 to weaning, five were found dead and 18 were missing at weaning and not found.

**P < 0.01.

Also summarized in Table 3 are calf deaths by category of greatest loss. Death due directly to or resulting from injuries and conditions caused by dystocia (18) accounted for the single largest loss category the first 96 h postpartum. A total of 410 deaths were caused by dystocia over the 15-yr study period, which was 45.9% of all losses (figures not shown in Table 3). Losses due to dystocia resulted in 69.6, 39.6, 30.8 and 33.3% of the total calf deaths for Days 0 through 3 postpartum, respectively. The majority of loss attributed to dystocia occurred within the first 24 h postpartum and accounted for 40.0% of total calf deaths.

Calves euthanized because of serious injuries or due to presence of congenital defects represented the largest loss category at Day 4 postpartum. If genetic abnormalities were identified (e.g., hydrocephalus), the findings served as culling criteria for both sire and dam. Pneumonia and/or scours accounted for the largest cause of calf loss from Days 6 through 41. Actual cause of death was not ascertained for many of the calves that died from Day 42 to weaning since the majority of the calves were missing and not found.

Values summarized (Table 4) indicate time of calf death was similar for all dam age and parity groups, with the majority of losses in all dam age groups being highest during the first 24 h postpartum. The consistency and similarity observed in percentage calf loss, regardless of dam age and parity over time postpartum, is noteworthy and important in making management decisions regarding efforts to reduce calf deaths in all dam age groupings. A summary of deaths by calf sex, classified by time at which the calves died is provided in Table 4. Differences regarding incidence of mortality between sexes was highly significant (males, 57.6% vs females, 42.4%) and confirms findings previously reported (8,10). The expected sex ratio for purposes of analysis was obtained from the contemporary herdmate ratio of 50.7% males and 49.3% females. Although total death loss was higher among males, no difference was apparent between sexes as to the actual time at which death occurred (sex by time, $P > 0.10$).

Data summarizing backward and breech presentations are also shown (Table 5). During the 15-yr study period, 294 parturitions were recorded involving calves presented either backward or breech. The 294 parturitions represented 2.2% of all parturitions during the study period. Backward presentations occurred more frequently than breech (1.6% vs 0.6%, respectively, $P < 0.01$). The incidence of backward presentation was highest (5.6%) in primiparous 3-yr-old dams, lowest (0.9%) in multiparous dams and intermediate in primiparous 2-yr-old dams (2.3%). The difference between primiparous 2- and 3-yr-old dams was highly significant as was the comparison of 2-yr-old vs multiparous and the nonorthogonal comparison of primiparous 3-yr-old vs multiparous dams. These percentages are similar to those of a previous report (29). The cause(s) of the higher incidence of backward presentations in primiparous dams is not understood, but may be related to strength of uterine contractions or uterine capacity and body space and the ability of the uterus or calf to force/make position and postural changes prior to and during the early stages of parturition. The higher incidence of backward presentations in parturitions from 3-yr-old primiparous dams may further indicate a physiological difference between dams experiencing the first parturition as a 3-yr-old rather than a 2-yr-old. However since the two age groups are not totally comparable in terms of genetic makeup of the dam or calf, the difference must be interpreted with caution. The final answer awaits further work.

Of the 215 calves born in backward presentation, 64.2% were males and 35.8% were females ($P < 0.01$). The difference in sex ratio was similar within the three dam-age groupings, and this finding is in agreement with other studies indicating that male calves experience more problems and have a greater death rate at parturition than females.

Table 4. Time of calf loss by dam age and parity and calf sex

Age and parity of dam	Time of death (days) ^a											
	0		1-10		11-41		42-101		101-weaning		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
First-calf												
2-yr	139	56.7 ^b	56	22.8	31	12.6	6	2.4	13	5.3	245	27.4
3-yr	72	59.5	22	18.2	12	9.9	9	7.4	6	5.0	121	13.5
Pluriparous ^c												
3-yr	28	46.7	15	25.0	6	10.0	6	10.0	5	8.3	60	6.7
4-yr	96	61.9	27	17.4	8	5.2	14	9.0	10	6.4	155	17.4
5-yr	49	64.5	15	19.7	7	9.2	4	5.3	1	1.3	76	8.5
6- to 8-yr	93	53.8	46	26.7	16	9.2	10	5.8	8	4.6	173	19.4
9- to 12-yr	36	57.1	14	22.2	7	11.1	2	3.2	4	6.3	63	7.0
Total/percent ^d	513	57.4 ^c	195	21.8	87	9.7	51	5.7	47	5.3	893	100.0
Calf sex ^e												
Male	288	56.5	113	22.2	53	10.4	28	5.5	28	5.5	510	57.6 ^{**}
Female	212	56.4	80	21.3	42	11.2	23	6.1	19	5.1	376	42.4

a Day 0 = first 24 h postparturition; time main effect, $P < 0.01$.

^b Row percentages.

c Second calf or greater.

d Percentage of 893 total deaths.

^e Sex of calf, not recorded for 4 calves, 3 intersex not included.

****P < 0.01.**

Table 5. Backward and breech presentation data summarized by dam age-parity and calf sex^a

Item	Backward				Breech			
	Percent total births in study	Born No.	%	Survival %	Percent total births in study	Born No.	%	Survival %
Primiparous								
2-yr-old	2.3 ^b	52	24.2	59.6	0.5	11	13.9	54.5
Calf sex: Male		34	65.4*	61.8		7	63.6	57.1
Female		18	34.6	55.6		4	36.4	50.0
3-yr-old	5.6 ^c	78	36.3	80.8	0.6	9	11.4	33.3
Calf sex: Male		49	62.8*	81.6		5	55.6	40.0
Female		29	37.2	79.3		4	44.4	25.0
Multiparous								
0.9 ^d		85	39.5	68.2	0.6	59	74.7	28.8
Calf sex: Male		55	64.7**	70.9		27	45.8	37.0
Female		30	35.3	63.3		32	54.2	21.9
Total								
1.6 ^e		215	100.0	70.7 ^g	0.6 ^f	79	100.0	32.9 ^h
Calf sex: Male		138	64.2**	72.5		39	49.4	41.0
Female		77	35.8	67.5		40	50.6	25.0

^a Data summary based on all calvings in 15-yr study, includes both live and dead calves.^{b,c,d} Backward presentation-dam age comparisons, $P < 0.01$.^{e,f} Total incidence of backward vs breech presentations, $P < 0.01$.^{g,h} Survival of backward vs breech presentation, $P < 0.01$.* $P < 0.05$, male vs female.** $P < 0.01$, male vs female.

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A total of 79 parturitions involved calves in the breech position. Differences due to age of dam grouping in percentage incidence or in sex of calf experiencing breech presentations were not significant.

The difference in survival of calves delivered in the backward vs breech presentation was highly significant (70.7 vs 32.9%, $P < 0.01$). In addition, survival rates of calves presented in the backward or breech position were lower ($P < 0.01$) than the contemporaneous survival rates of calves born in the normal presentation. Contemporary survival rates were 89.1, 91.3 and 94.5% for primiparous 2- and 3-yr-old dams and multiparous dams, respectively. These survival differences indicate that breech presentations are a more serious complication of parturition than backward presentations. This may be partially due to the difficulty in recognizing breech presentations at an early stage so that obstetrical intervention can be made in a timely manner. The possibility that technicians need additional training in correctly giving obstetrical assistance in parturitions involving breech presentation is also a possibility that must be recognized.

Birth weights of calves born in the backward or breech presentation are summarized (Table 6). Calves born in backward presentation were heavier ($P < 0.05$) than those born in breech presentation. Pooling birth weights of calves in both backward and breech categories showed an increase in average birth weights by age of dam grouping, with birth weights from primiparous 3-yr-old and multiparous dams being significantly heavier than those from primiparous 2-yr-olds. These differences are in agreement with dam age effects on birth weights reported previously (30). Birth weights of the 177 male calves born in backward or breech presentation averaged 3.4 kg heavier ($P < 0.05$) than females born with these presentation complications. The birth weight differences are in general agreement with dam age effects and calf sex differences noted throughout this study and by others (31,32).

Results from this study indicate improved management can be pinpointed as the critical factor for reducing calf losses regardless of dam age. This conclusion was reached by noting that losses from dystocia (Day 0 to 3), accidents (Day 5), disease (Day 6 to 41) and missing calves (Day 42 to weaning) were the greatest causes of calf deaths identified within the respective time periods. Losses from these four categories could be reduced by better management and observation of the dam at and during parturition, appropriate calf management, including disease prevention and control and effective observation to detect and prevent "missing" calves after the dam-calf pair have been placed on pasture.

Effect on the Dam

Of the 893 dams that lost calves during the study period, 722 reentered breeding herds in the breeding season immediately following calf loss and were retained until the fall pregnancy test. Of the 171 dams not retained, 30 (17.5%) died, 133 (77.8%) were sold prior to the beginning of the breeding season, and 8 (4.7%) were sold or died prior to fall pregnancy test. The effects of calf loss on subsequent pregnancy of the 722 dams compared to dams that had not lost calves are summarized (Table 7).

Table 6. Birth weights of calves presented backward or breech summarized by presentation, age and parity of dam and calf sex

Item	No. of calves	Average birth weight, kg
Presentation at birth		
Backward	215	35.2a
Breech	79	33.4b
Age and parity of dam		
2-yr-olds	63	32.1c
1st-calf 3-yr-olds	87	34.8d
Multiparous dams	144	35.8d
Calf sex		
Male	177	36.0e
Female	117	32.6f

a-f Means within category with different superscripts differ ($P < 0.05$).

Table 7. Subsequent pregnancy rates of cows losing calves

Age and parity of dam	No. females exposed for breeding	Pregnancy rate year following calf loss	
		No. pregnant	%a
2-yr-olds losing calves	196	137	69.9
Contemporary 2-yr-olds ^b	2,053	1,536	74.8
1st-calf 3-yr-olds losing calves	112	87	77.7
Contemporary 3-yr-olds ^b	1,377	1,081	78.5
Multiparous dams losing calves	414	299	72.2 ^c
Contemporary multiparous dams ^b	9,481	7,630	80.5 ^d
Total losing calves ^e	722	523	72.4 ^c
Contemporary total	12,911	10,247	79.4 ^d

^a Row percentages.

^b Contemporary dams were within same year and age grouping but calves survived.

^{c,d} Percentages with different superscripts differ ($P < 0.01$).

^e Represents total number retained for breeding; see text for explanation of additional 171 dams.

A nonsignificant trend for lower fall pregnancy rate was found in first-calf 2- and 3-yr-old dams. However, multiparous dams that lost calves had an 8.3% lower pregnancy rate than contemporaries that did not lose calves ($P < 0.01$). The pooled difference between the two dam groupings was 7.0% ($P < 0.01$), which reflects the trends toward lower pregnancy

rates in all age groupings in dams that lost calves. Causes of this reduction could not be determined from data available from this study, although calf loss may have delayed resumption of estrous cycles or may have resulted in physical exhaustion or trauma of the reproductive tract of the dam as a sequela to calf death (33).

Additional evaluation of the effect of calf death on subsequent pregnancy of the dam was determined by comparing pregnancy rates of dams losing calves from dystocia with dams losing calves from all other causes. Values are summarized (Table 8). No significant differences were found for dystocia vs nondystocia and differences were not affected by dam age grouping. These results indicate that the depression in subsequent pregnancy rate was not specifically traceable to dystocia but apparently to some general effect of calf loss. We do not identify causes of this general effect, but the reduced pregnancy rate in dams experiencing calf loss has also been found by others (10,15). Results of this study clearly indicate that calf loss has a major economic impact on the net calf crop directly through calf deaths and indirectly through the subsequent reduced pregnancy rate of dams that lost calves. The magnitude and impact of calf deaths on production efficiency could be reduced through improved management practices.

Table 8. Fall pregnancy rates of dams that lost calves following dystocia vs nondystocia parturitions

Age and parity of dam	Cause of calf death					
	Dystocia			Nondystocia ^a		
	No.	Pregnant		No.	Pregnant	
	exposed	No.	% ^b	exposed	No.	% ^b
Primiparous						
2-yr-olds	93	62	66.7	82	58	70.7
3-yr-olds	48	39	81.2	52	38	73.1
Multiparous dams	168	118	70.2	199	144	72.4
Total	309	219	70.9	333	240	72.1

^a Includes all calf deaths not caused by dystocia.

^b Row percentages.

Differences, $P > 0.10$.

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